



U.S. General Services Administration

Open Source e-Gov Reference Architecture AIC ET Briefing 10/20/03

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Agenda

- [1] GSA OSERA
 - Program, Platform and Projects
- [2] MDA, MOF, XMI
 - EA Models and View Isometrics
- [3] SOA, SOIP-BPMS
 - Agile SDLC, ARAD for e-Gov
- [4] PortMan POC
 - Model simulation and artifact generation
- [5] OSERA Revisited
 - Project Goals
- [6] SBIR/STTR
 - OSERA Research topics

[1] OSERA Program: Business Value Proposition

- Purpose
 - Aggregates existing but separately developed and maintained Open Source software Projects into a consolidated GSA managed software Platform that provides the infrastructure for sharing and federation of Enterprise Architecture model artifacts, and e-Gov interoperability
- Objective
 - Provides an open standards based, Open Source software toolset implementing the most significant architecture and integration trends and innovations, including a Model Driven Architecture Integrated Modeling Environment (MDA-IME), and a Service Oriented architecture Integration Platform acting as a Business Process Management System (SOIP-BPMS)
- Benefit
 - A transformation enabling modernization platform for EA and e-Gov, connecting ‘design time’ and ‘run time’ tools with an extremely low cost, Internet open standards based, universally accessible Open Source software suite

[1] OSERA Project: EA MDA-IME Design Tools

- Purpose
 - Simplify and unify EA processes and artifacts, alleviating ‘modeling fatigue’ associated with disparate analysis practitioners and methodologies, and eliminating the ad-hoc interpretation of their resulting documentation
- Objective
 - Formalize modeling syntax and semantics for comprehending, sharing, and reusing business and technical components that must interoperate, or otherwise participate in existing or planned shared services across Federal, State and Local Agencies
- Result
 - Enable change by making Business Agility and IT Systems Adaptability the design center of EA, accepting constant evolution of Business requirements and IT systems heterogeneity as the rule for e-Gov constituents

[1] OSERA Project: e-Gov SOIP-BPMS Runtime Tools

- Purpose
 - Move the focus of IT interoperability from monolithic stand-alone applications to message sequences that cross enterprise and geographic boundaries, to realize the vision of e-Gov transformation
- Objective
 - Embrace the logical ‘publish-find-bind-execute’ Web Services paradigm and provide the physical infrastructure for a fault-tolerant ‘Enterprise Service Bus’, integrating declarative XML Web services standards based business process descriptions with a J2EE application server
- Result
 - A runtime engine for contractually driven business process choreography execution, that can represent any sequence in a business value chain interaction, whose logical processing components are implemented using a mature platform independent enterprise technology

[1] OSERA Program: GSA Business Proposition

- The Open Source community by definition cannot provide a cohesive software Platform that satisfies specific Federal/State/Local needs for these OSERA Platform solution user communities;
 - EA knowledge management requirements
 - Cross analyze OMB CPIC data to drive Government transformational effort
 - e-Gov interoperability requirements
 - NASCIO as part of DHS mission, overall redundancy elimination and cost reduction initiatives, etc.
- GSA is in a unique position to aggregate, extend and manage existing Open Source software projects into a cohesive Platform for both EA and e-Gov constituencies

[1] OSERA Program: Ecosystem

- GSA as Platform distributor and channel enabler
 - Program policy and governance
 - License goal - guaranteed reciprocity and indemnification
 - Platform vision and roadmap
 - EA and e-Gov initial constituency with MDA-IME and SOIP
 - Product and Service Supply Chain Agent
 - Project principals as core service/support contractors
- (Small) Business and existing Open Source Communities
 - Project Maintainers and technology experts
 - Core Service Providers
- Academia
 - Project feature/function task force
 - Accredited curricula
 - Project Maintainers and technology experts

[2] MDA Overview

- MDA modeling *separates* strategic business conceptual models from tactical systems implementation models
 - MDA Models can represent current ‘as-is’ or planned ‘to-be’ capabilities
- The strategic and conceptual modeling of any business (Agency) as a set of *collaborating roles, entities and processes* leads to;
 - A Platform Independent Model (PIM) that is separate from (and hopefully will outlast) any existing or planned IT systems implementation
 - That is represented by a Platform Specific Model (PSM)
- EA needs MDA to homogenize modeling (syntax and semantics) for successful sharing and reuse of components that participate in existing or planned shared services across Federal, State and Local Agencies

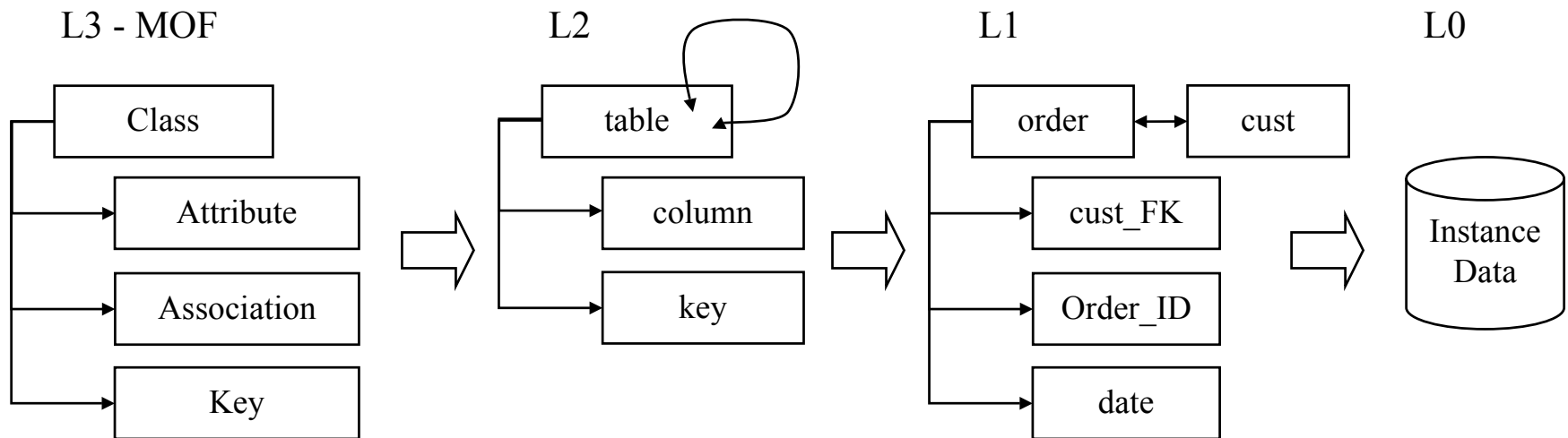
[2] MDA PIM and PSM

- A PIM is ‘transformed’ to a PSM ‘instance’ using a meta-model of that specific target implementation platform
- PSM target platforms include technologies such as CORBA, EAI, J2EE, .NET, Web services, ebXML, etc.
- PIM and PSM decoupling is required where the conceptual or contextual PIM of a business may change, e.g. DHS
- MDA’s underlying modeling formalism (MOF-XMI) enables the *view isometrics*, *recursive decomposition* (progressive refinement) and automatic code generation that results in a transformation of a PIM to a PSM

[2] MDA's Underlying Semantic/Syntactic Formalism

- The Meta Object Facility (MOF) underlies UML and MDA, with four modeling levels moving from abstract to concrete
 - L3, meta-meta-model of objects required to describe *any meta-model*
 - An 'class' is the highest level of abstraction
 - L2, meta-model objects that can be used to describe *any business domain or technology platform*
 - A 'table' is a specialization of 'class'
 - L1, model objects that describe a *specific business domain or technology platform*
 - An 'ORDER' is an instance of a 'table'
 - L0, data instances of L1 models
 - The specific order data record that is stored in the ORDER 'table'
- XMI is the textual serialization format for MOF objects, expressed as XML documents
 - XMI based information sharing is the key to EA KM

[2] MDA – MOF (L3, L2, L1, L0) RDBMS example

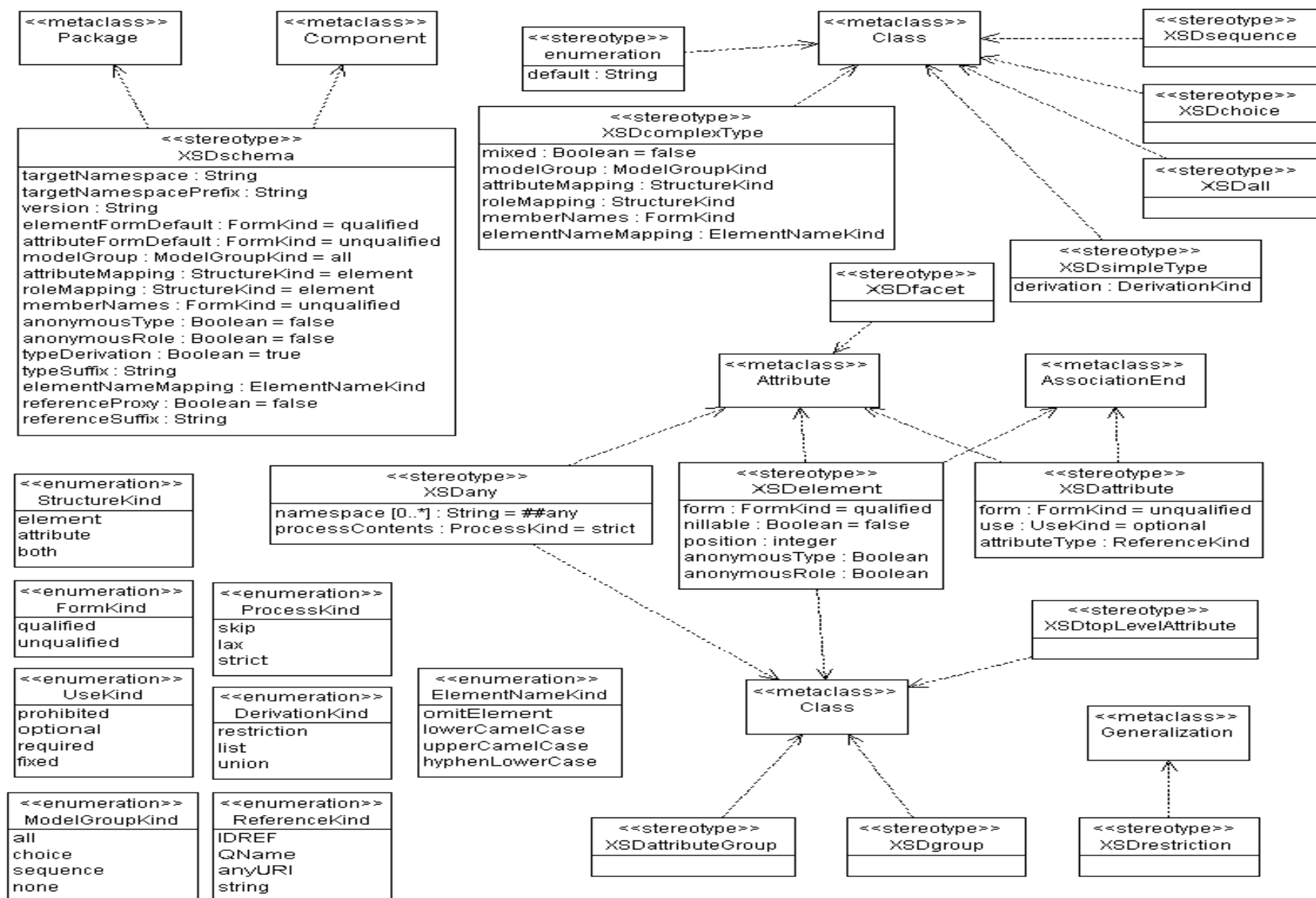


- Moving from far left (L3) to far right (L0) represents a specialization of the highest meta-level abstraction to the concrete instance of the domain being modeled
 - Continuing with the RDB example
- Consider the DRM for example - the XML Schema specification (XSD) from W3C is a L2 meta-model whose UML representation is isometric
 - An XSD domain dialect is a L1 model (such as UBL, etc), and a valid instance of that L1 XSD is a L0 XML document/object

[2] HyperModel – View Isometrics in Eclipse

- Eclipse is a standards based Open Source ‘application foundation’
 - Open Source community eclipse.org seeded by IBM
 - Eclipse is the core code base of IBM’s commercial J2EE IDE, WebSphere Solution Application Developer
 - Extensible via ‘plug-in’ architecture
- Ontogenics (company) offers HyperModel (tool) as an Eclipse plug-in
 - Uses OMG’s MOF and XMI technologies to deliver isometric views of UML <->XSD
 - Based on the Java Metadata Interface (API) - jmi.jar
 - xmlmodeling.com
 - Implemented by creating a UML Profile for XSD
 - UML Profiles are collections of stereotypes
 - UML extensibility mechanisms

[2] UML Profile for <<XSDSchema>> package



XMLmodeling - FEA.xmi - hyperModel Application

File Edit Navigate Search Project Run XMLmodeling Window Help

UML Models

FEA

FEA_XML_Schema_Rev_1.2

BusinessArea

BusinessAreaDetails

(BusinessArea)

BusinessAreaName

BusinessLine

BusinessLineDefinition ext

businessLineID

businessLineID

BusinessLineName

refbusinessAreaID

refbusinessAreaID

(SubFunctionDetails)

BusinessLineDetails

(BusinessLine)

BusinessLineName

BusinessReferenceModel

Component

ComponentDetails

ComponentName

DeliveryMode

DeliveryModeDetails

DeliveryModeFunction

DeliveryModeFunctionDetails

New

Open With

Delete

Properties

XML Schema

UML Diagram

XML Elm Tree

HTML

Navigator

UML Models

Properties

Property	Value
Misc	
file	FEA.xmi
UML	
name	FEA_XML_Schema_Rev_1.2
stereotype	XSDschema
name	XSDschema
stereotype	
XML Schema	
anonymousRole	
anonymousType	

Properties

Documentation

Xm*FEA.xmi

Temp.xsd

History: file:///C:/Documents%20and%20Settings/GeorgeThomas/My%20Documents/hyperM

Package: «XSDschema»

FEA_XML_Schema_Rev_1.2

Tagged Values: { version=1.2 , elementFormDefault=qualified , attributeFormDefault=unqualified , targetNamespace=urn:us:gov:omb:fea , targetNamespacePrefix=fea }

Depends On:

class BusinessLineDetails (from FEA_XML_Schema_Rev_1.2)

Tagged Values: { }

Attributes

Associations

BusinessLine [1..*] { position=1 }

Operations

UML Diagram

XML Diagram

Web View

XMLmodeling Messages

FEA::FEA_XML_Schema_Rev_1.2

XMLmodeling - Temp.xsd - hyperModel Application

File Edit Navigate Search Project Run XMLmodeling Window Help

UML Models

FEA

FEA_XML_Schema_Rev_1.2

BusinessArea

BusinessAreaDetails

BusinessAreaName

Management of Government Resources

Management of Government Resources (Cross-Agency)

Services for Citizens

Support Delivery of Services

Support Delivery of Services (Cross-Agency)

string

BusinessLine

BusinessLineDetails

BusinessLineName

BusinessReference

businessReference

(BusinessArea)

(DeliveryManagement)

Component

ComponentDefinitionText

ComponentName

refserviceDomainID

refserviceTypeID

ComponentDetails

ComponentName

New

Open With

Delete

Properties

XML Schema

UML Diagram

XML Elm Tree

HTML

Navigator

UML Models

Properties

Property	Value
UML	
abstract	false
name	BusinessLineName
stereotype	enumeration
name	enumeration
stereotype	
XML Schema	
appinfo	
default	
id	

Properties

Documentation

FEA.xmi

Temp.xsd

```
1<?xml version="1.0" encoding="ISO-8859-1"?>
2<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:fea="
3
4  <!-- ===== -->
5  <!-- Package: <<XSDschema>> FEA_XML_Schema_Rev_1.2 -->
6  <!-- ===== -->
7  <!-- ===== -->
8  <!-- Class: BusinessLineDetailsType -->
9  <!-- ===== -->
10 <xs:element name="BusinessLineDetails" type="fea:BusinessLineDe
11 <xs:complexType name="BusinessLineDetailsType">
12   <xs:sequence>
13     <xs:element ref="fea:BusinessLine" minOccurs="1" maxOccurs
14   </xs:sequence>
15 </xs:complexType>
16
17 <!-- ===== -->
18 <!-- Class: <<enumeration>> BusinessLineName -->
19 <!-- ===== -->
20 <xs:simpleType name="BusinessLineName">
21   <xs:restriction base="xs:string">
22     <xs:enumeration value="Accounting"/>
23     <xs:enumeration value="Accounting (Cross-Agency)"/>
24     <xs:enumeration value="Agricultural Innovation and Service
25     <xs:enumeration value="Air Transportation"/>
26     <xs:enumeration value="Asset and Liability Management"/>
27     <xs:enumeration value="Asset and Liability Management (Cro
28     <xs:enumeration value="Benefits Management"/>
29     <xs:enumeration value="Benefits Management (Cross-Agency)"
30     <xs:enumeration value="Border and Transportation Security"
31     <xs:enumeration value="Budget and Finance"/>
32     <xs:enumeration value="Budget and Finance (Cross-Agency)",
33     <xs:enumeration value="Budget Execution"/>
34     <xs:enumeration value="Budget Execution (Cross-Agency)"/>
35     <xs:enumeration value="Budget Formulation"/>
36     <xs:enumeration value="Budget Formulation (Cross-Agency)",
37     <xs:enumeration value="Business and Industry Development",
38     <xs:enumeration value="Capital Planning"/>
```

XMLmodeling Messages

FEA::FEA_XML_Schema_Rev_1.2::BusinessLineName



UML Models

- BusinessLineName
 - Accounting
 - Accounting (Cross-Agency)
 - Agricultural Innovation and Services
 - Air Transportation
 - Asset and Liability Management
 - Asset and Liability Management (Cross-Agency)
 - Benefits Management
 - Benefits Management (Cross-Agency)
 - Border and Transportation Security
 - Budget and Finance
 - Budget and Finance (Cross-Agency)
 - Budget Execution
 - Budget Execution (Cross-Agency)
 - Budget Formulation
 - Budget Formulation (Cross-Agency)
 - Business and Industry Development
 - Capital Planning
 - Capital Planning (Cross-Agency)
 - Catastrophic Defense
 - Central Fiscal Operations
 - Central Fiscal Operations (Cross-Agency)
 - Central Personnel Management

Navigator UML Models

Properties

Property	Value
UML	
abstract	false
name	BusinessLineName
stereotype	enumeration
name	XSDcomplexType
stereotype	XSDsimpleType
XML Schema	XSDany
appinfo	enumeration
default	XSDsequence
id	

Properties Documentation

*FEA.xmi Temp.xsd

```

1 <?xml version="1.0" encoding="ISO-8859-1"?>
2 <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:fea="u
3
4   <!-- ===== -->
5   <!-- Class: <<enumeration>> BusinessLineName -->
6   <!-- ===== -->
7   <xs:simpleType name="BusinessLineName">
8     <xs:restriction base="xs:string">
9       <xs:enumeration value="Accounting"/>
10      <xs:enumeration value="Accounting (Cross-Agency)"/>
11      <xs:enumeration value="Agricultural Innovation and Services
12      <xs:enumeration value="Air Transportation"/>
13      <xs:enumeration value="Asset and Liability Management"/>
14      <xs:enumeration value="Asset and Liability Management (Cross
15      <xs:enumeration value="Benefits Management"/>
16      <xs:enumeration value="Benefits Management (Cross-Agency)"/
17      <xs:enumeration value="Border and Transportation Security"/
18      <xs:enumeration value="Budget and Finance"/>
19      <xs:enumeration value="Budget and Finance (Cross-Agency)"/
20      <xs:enumeration value="Budget Execution"/>
21      <xs:enumeration value="Budget Execution (Cross-Agency)"/>
22      <xs:enumeration value="Budget Formulation"/>
23      <xs:enumeration value="Budget Formulation (Cross-Agency)"/>
24      <xs:enumeration value="Business and Industry Development"/>
25      <xs:enumeration value="Capital Planning"/>
26      <xs:enumeration value="Capital Planning (Cross-Agency)"/>
27      <xs:enumeration value="Catastrophic Defense"/>
28      <xs:enumeration value="Central Fiscal Operations"/>
29      <xs:enumeration value="Central Fiscal Operations (Cross-Age
30      <xs:enumeration value="Central Personnel Management"/>
31      <xs:enumeration value="Central Personnel Management (Cross-
32      <xs:enumeration value="Central Property Management"/>
33      <xs:enumeration value="Central Property Management (Cross-
34      <xs:enumeration value="Central Records and Statistics Manag
35      <xs:enumeration value="Central Records and Statistics Manag
36      <xs:enumeration value="Citizen Protection"/>
37      <xs:enumeration value="Collections and Receivables"/>
38      <xs:enumeration value="Collections and Receivables (Cross-

```

XMLmodeling Messages

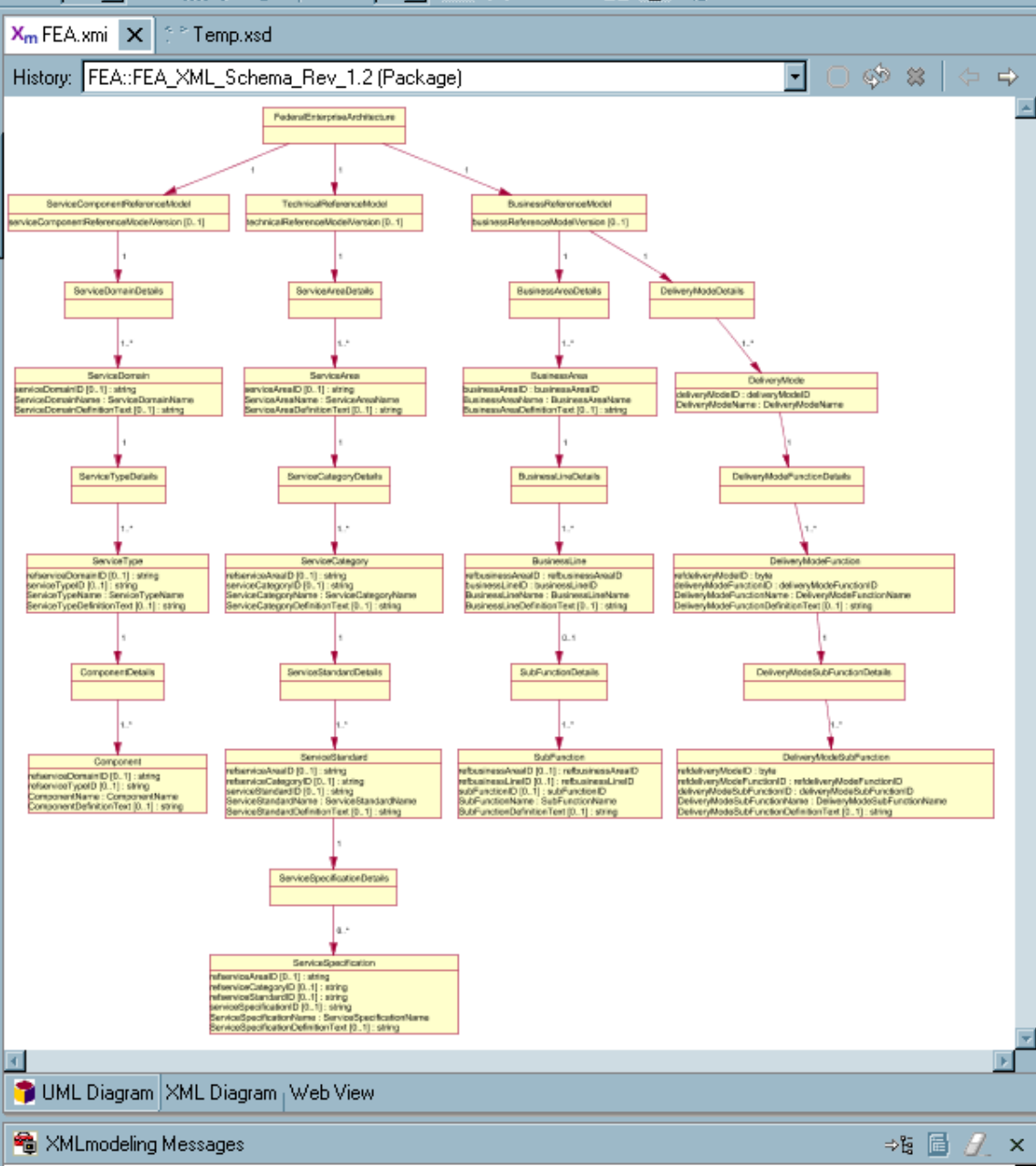
UML Models

- FEA
 - FEA_XML_Schema_Rev_1.2
 - BusinessArea
 - BusinessAreaDetails
 - BusinessAreaName
 - Management of Go
 - Management of Go
 - Services for Citizens
 - Support Delivery of Services
 - Support Delivery of Services (Cross-Agency)
 - ↑ string
 - BusinessLine
 - BusinessLineDetails
 - BusinessLineName
 - BusinessReferenceModel
 - businessReferenceModelVersion
 - (BusinessAreaDetails)
 - (DeliveryModeDetails)
 - Component
 - ComponentDefinitionText
 - ComponentName
 - refserviceDomainID
 - refserviceTypeID
 - ComponentDetails
 - ComponentName

Properties

Property	Value
Misc	
file	FEA.xmi
UML	
name	FEA_XML_Schema_Rev_1.2
stereotype	XSDschema
name	XSDschema
stereotype	
XML Schema	
anonymousRole	
anonymousType	

Properties Documentation



[3] Service Oriented Architectures (SOA): Overview

- SOA emphasizes *trans-enterprise interoperability* (Citizen to Agency to Agency = eGov) of loosely coupled distributed ‘Service’ components (WSDL) whose orchestrated XML based message choreographies (BPEL) *layer* (WS-*) open Internet standard transports and protocols
 - SOA *externalizes* EAI and OO-DBC disciplines, embracing the logical ‘publish-find-bind-execute’ paradigm referred to as an Enterprise Service Bus (ESB) for secure, reliable message transactions
- Web Services open standards are key foundation enablers for SOA, *moving the focus of IT interoperability from monolithic stand-alone applications to message streams that cross enterprise boundaries*
 - e-Gov Quicksilver?

[3] OSERA Project: SOIP - Tools Overview

- **JBOSS (HTTP, JSP, Servlet, EJB container)**
 - jboss.org
 - Runtime container management, message queues, declarative transactions and persistence, COTS ERP adapter/connectors, more
 - JMX, JMS-MDB, CMT, CMP-JDO, JCA, etc.
 - High Availability, Fault-tolerant Clusters
 - Managed server cloud
- **Apache Group**
 - xml.apache.org, jakarta.apache.org
 - Portal, Trans-coding, Web-Services, XML Native DB
 - JetSpeed, Cocoon, Axis, Xindice
- **Other - RDBMS, Search, Email**
 - PostgreSQL or MySQL, Lucene, James
- **Legacy wrapper Swiss army knife**
 - Open standards, Open Source modernization capability

[3] BPMS: Overview

- The BP Virtual Machine
 - A runtime engine for declarative (XML based - BPEL, BPML) *executable process scripts*
- Process script as the fundamental unit of management
 - Where communication meets computation
 - The context in which people and systems interact to create value for customers
 - The key *data type* and intellectual property of business that defines all value chain constituents
- The locus of business agility
 - Business people conceive, *deploy*, monitor and optimize process scripts using a formal standard for process representation
 - Competitive in-sourcing/out-sourcing is the capability to dynamically substitute actors implementing static roles defined as process participants (inferring a collapse of the SDLC)

[3] MDA vs. BPMS

- MDA comes from the OO community
 - omg.org/mda, promises to separate strategy from tactical systems deployment (PSM) with linkage from
- BPMS message is targeted at the Business community
 - bpmi.org, promises a standardized formalism for graphical process notations (BPMN), and isometric XML scripts (BPML)
- For various (marketing) reasons, their goals may seem at odds
 - See Frankel (MDA Expert/Author) and Smith (BPMS Expert/Author) white papers at businessprocesstrends.com
- EA needs to understand the linkage between business abstractions and system implementations
 - Recursive decomposition, views provided for disparate user needs
 - Business executive, capital planner, system architect, software developer
- BUT - Solving a particular B2B problem may not require recursive decomposition of a 'complex' model
 - The 'mother of all virtual machines' is an interesting proposition
 - One view (process diagrams), system linkages hidden as much as possible



SubProcess1

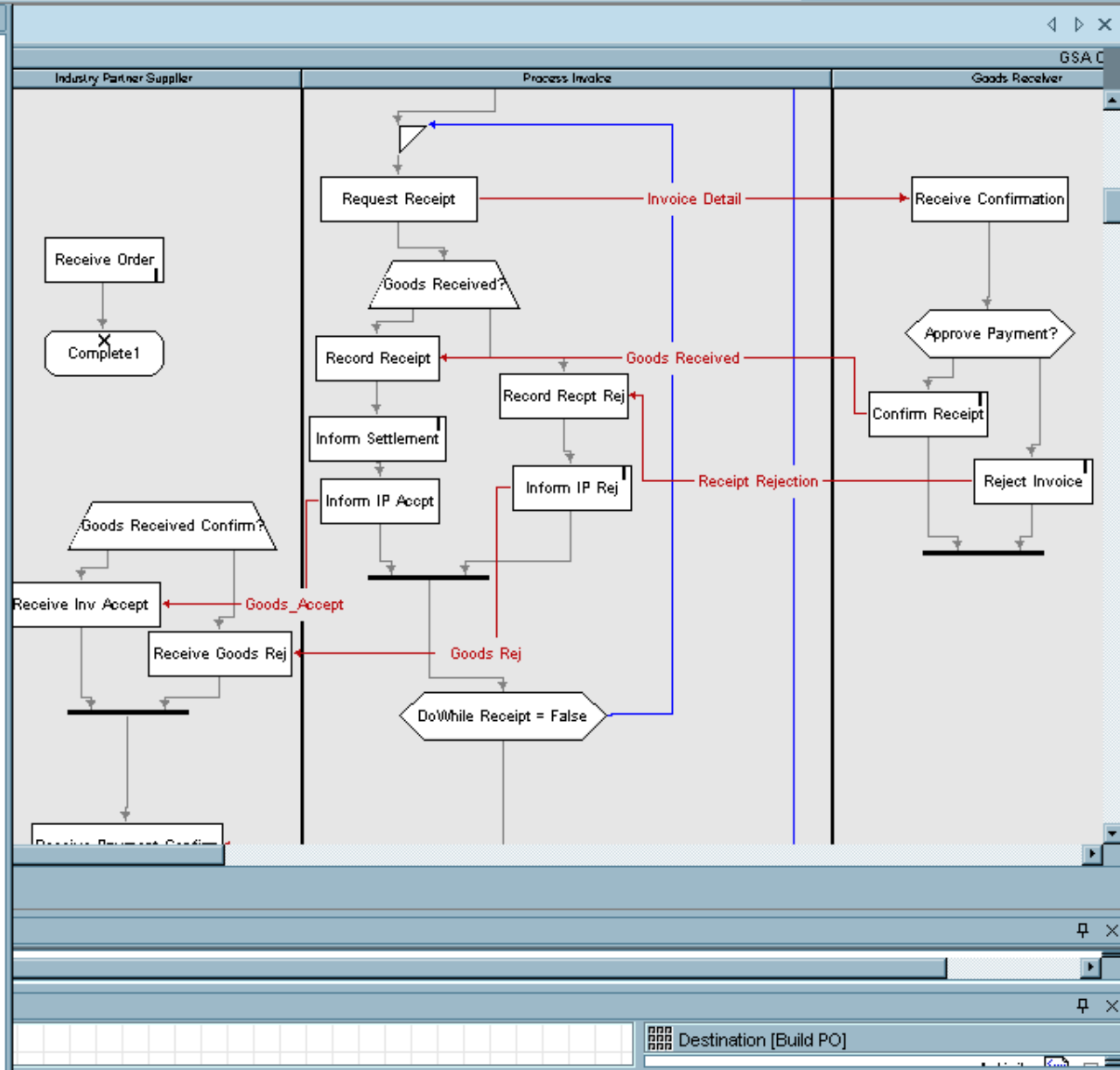
- Connectors
- Connectors
 - JAVA
 - JMS
 - Internal Queue
 - EJB
 - SOAP
 - JDBC
 - Mail
 - MQSeries
 - IIOP

Operators

Connectors

Director

Process Shapes



[5] EA Views and Perspectives

- A BPMN *view* is a *representational style* applied to an information model at a specific (low) level of abstraction
- GOAL - Established and accepted formalized process notation and corresponding (isometric) script that can represent public and private boundary crossing value chain interactions
 - Intalio's notation doesn't look like BPMN
 - Instance orientation is a tough read
- The number of views required is *relative*, and needs to mirror the roles of whatever humans are engaged in using EA tools or models to understand how IT helps to run an organizations' business
- A *perspective* combines multiple views into a consolidated UI
 - Eclipse makes it easy to create a custom perspective which can combine views arbitrarily

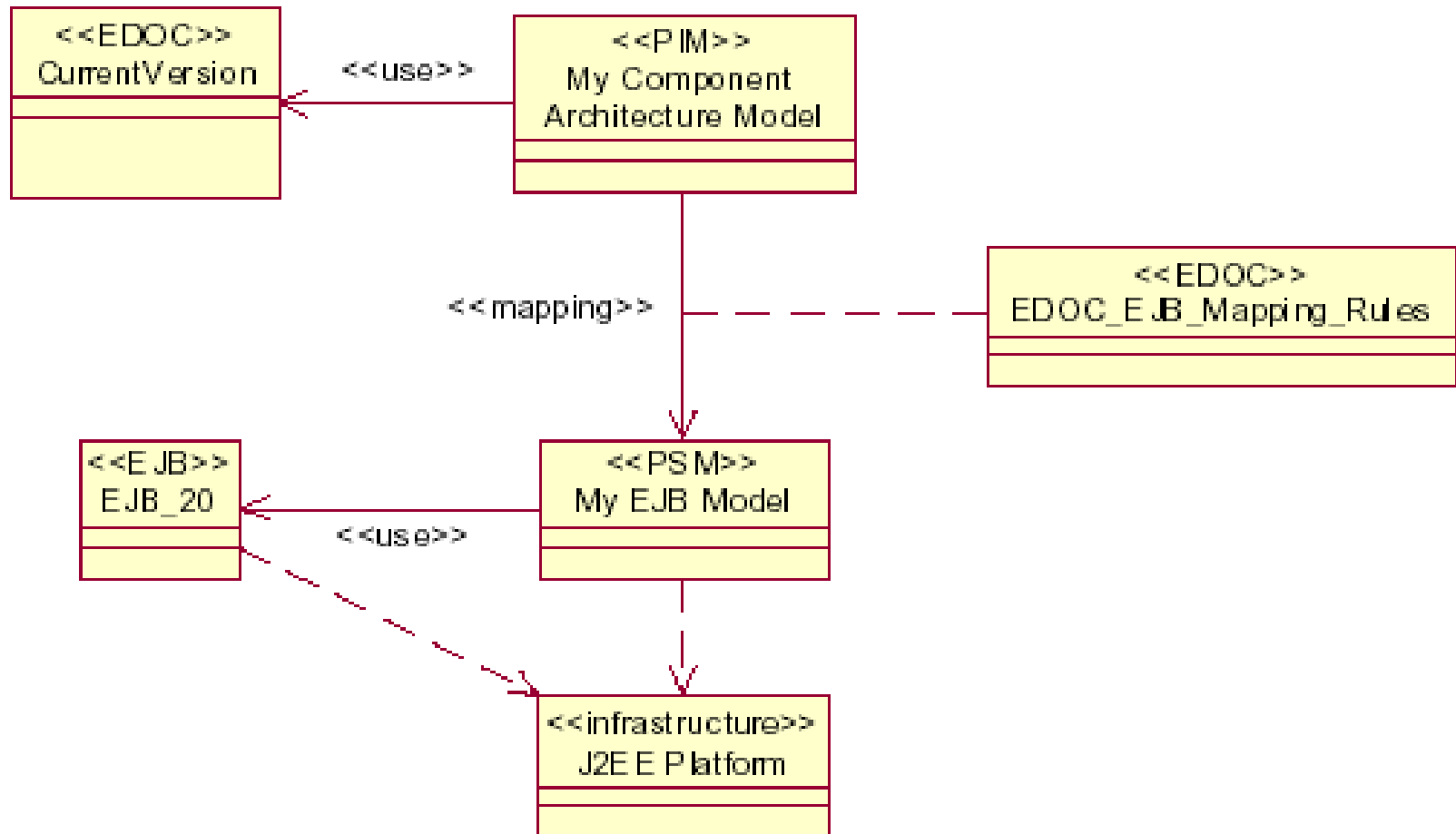
[3] SOIP as BPMS

- A typical BPMS product suite is a process engine (process virtual machine) that runs the declarative scripts generated by a process design tool, that uses a process repository
- The OSERA Project: SOIP-BPMS basically needs to implement the fundamental runtime semantic constructs as a set of object dynamics
 - This is the same exercise as making an object model out of an existing XSD, here beginning with BPMN/BPML/BPEL
- The toolset just described for OSERA Project: SOIP-BPMS can be used to implement the process runtime engine, or business process virtual machine (BPVM)
 - The runtime engine of BPMS is a SOIP!
 - jbpl.org is interesting Open Source Academic initiative working on this BPVM idea

[4] Setting up the ‘PortMan POC’ Demo

- Data Access Technologies (company) ComponentX (tool) implementation of their OMG ratified Enterprise Distributed Object Computing (EDOC) UML Profile for MDA
 - EDOC is an elegant expression of SOA
 - enterprise-component.com
- EDOC is the *actionable formalism* to model GSA roles, actors that play them (people and/or machines), and their collaborative responsibilities
 - GSA ‘business’ package – the PIM
 - GSA ‘technology’ package – the PSM
- UBL data types and messages travel through the GSA model
- Model simulation runs can interact with existing systems with a choice of *adapters*

[4] MDA UML Profile: EDOC PIM, J2EE PSM



[4] GSA baseRole (EDOC) Quick Reference 1 of 2

- **BusinessCollaboration** *is a*
 - **CommunityProcess**, which is the central concept of any enterprise specification is that of a *community* that models a collection of entities interacting to achieve some purpose, which is defined by the *objective* of the community concerned
 - Each community is modeled as a configuration of *enterprise objects in roles*. The EDOC system of concern (or the components of that system) is modeled as one or more of the enterprise objects that are the members of the community
- **ServiceRole** *is a*
 - **ProcessRole**, which identify the parts of the business processes for which the system is responsible and the artifacts that are involved
 - An EDOC system or each component of that system is modeled as an enterprise object and is assigned a role or roles in the community and associated with specific parts of one or more processes

[4] GSA baseRole (EDOC) Quick Reference 2 of 2

- **ComponentEndpoint** *extends*
 - An *endpoint*, which models a set of role resources for accessing an external role
 - Endpoints may only contain role resources
- **DataEndpoint** *extends*
 - An *endpoint*, can be thought of as a ‘system of record’ or data persistence resource
- **ComponentEngine** *extends*
 - An *engine*, which provides an execution environment for the set of components it contains
 - The engine is instantiated at runtime based on a distinguished aspect (WSDL, ebXML, etc)
 - Engines are composite components and may contain proxies and regular components



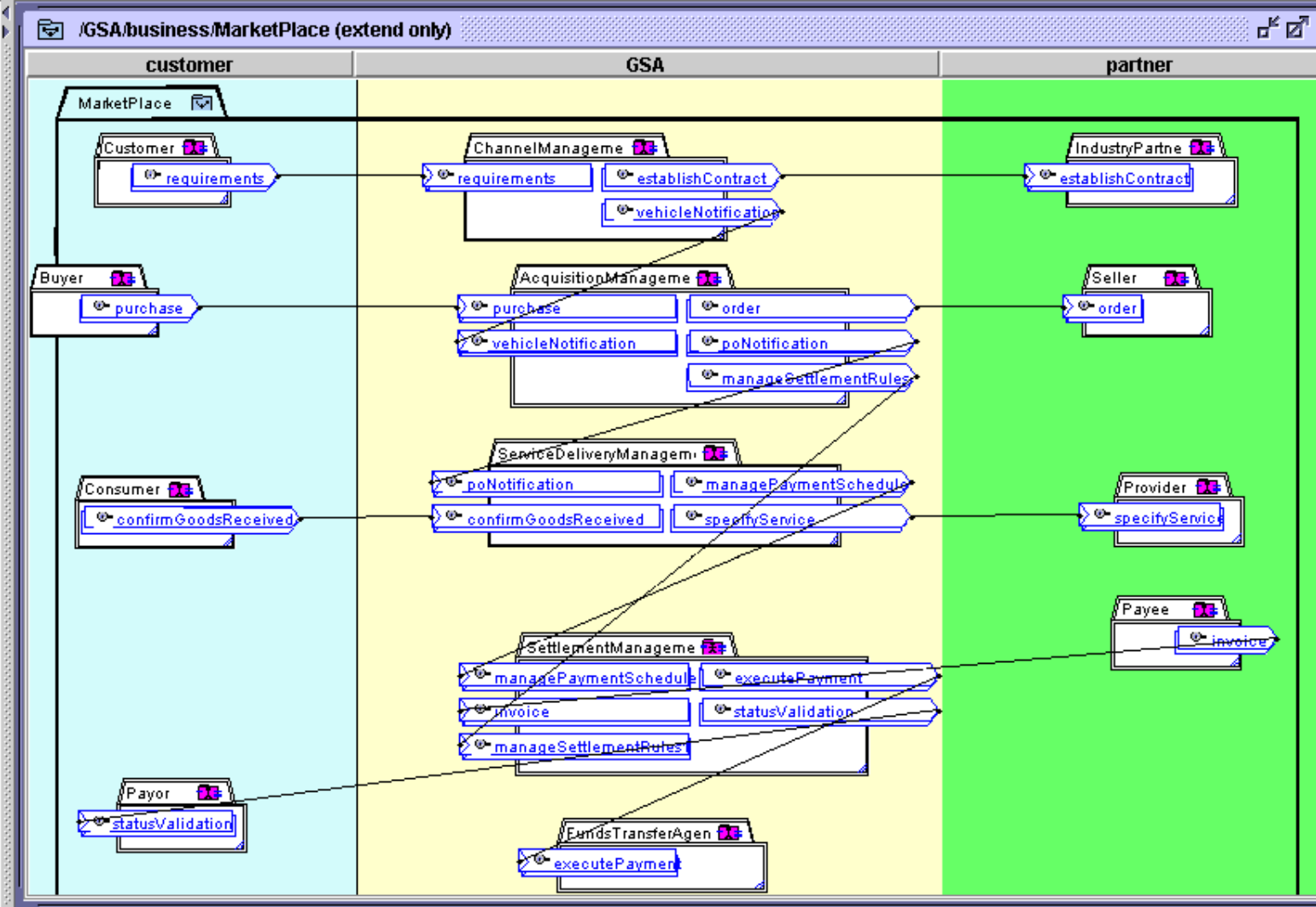
Framework

BusinessCollaboration ComponentEndpoint DataEndpoint ServiceRole

core database editAnt editJSP editXSL FEA xmldb ubl

enterpriseModels:GSA.gs...

- FEA
- GSA
 - business
 - BuyerAgents
 - MarketPlace
 - protocol
 - role
 - data
 - demo
 - service
 - BuyerAgents
 - Acquisition
 - ChannelM
 - FundsTra
 - GSAbuyS
 - ServiceD
 - Settleme
 - simulation
 - technology
 - Consumer
 - ConsumerEr
 - ConsumerEr
 - GSAbuySelle
 - GSAbuySelle
 - IndustryPartn
 - IndustryPartn
 - IndustryPartn
 - ProvisionTes
 - UnallocatedE
 - tool
 - ui

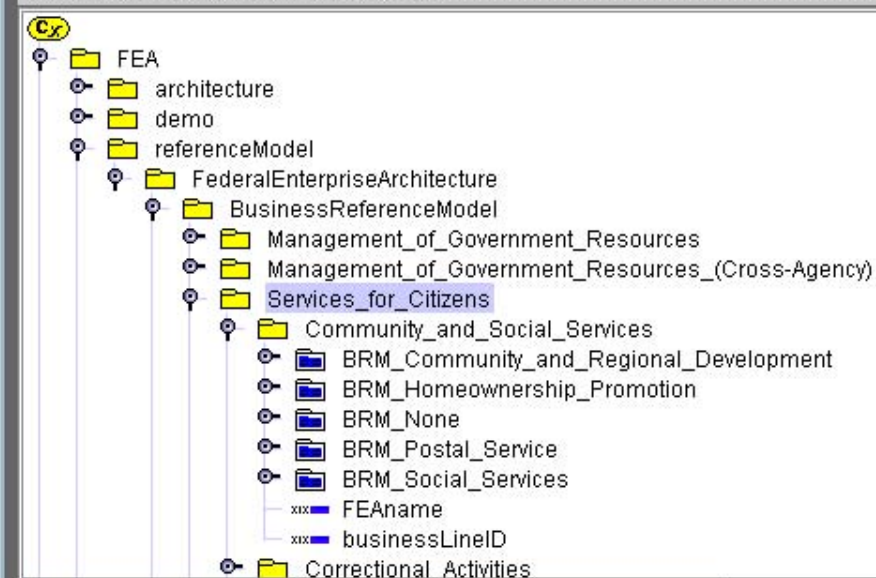




Framework



enterpriseModels:GSA.gsaService



/FEA/referenceModel/FederalEnterpriseArchitecture/BusinessRefere...

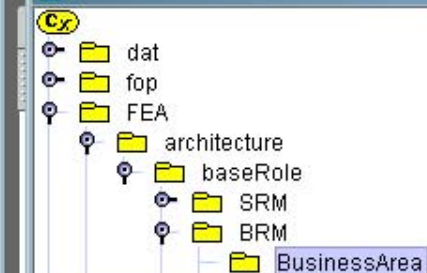
File Edit Font Color Help



The Services For Citizens Business Area describes the mission and purpose of the United States government in terms of the services it provides both to and on behalf of the American citizen. It includes the delivery of citizen-focused, public, and collective goods and/or benefits as a service and/or obligation of the Federal Government to the benefit and protection of the nations general population.

Base URL:

instanceof



Close

Property

Component

Property	value
name	Services_for_Citizens
instanceof	/FEA/architecture/baseRole/BRM/BusinessArea
className	com.dat.cx.CxPackage
project	enterpriseModels:GSA.FEA
icon	images/comp2pkg.gif
toolTipText	base package definitions for a BRM Business Area
businessAreaID	1
FEAname	Services for Citizens



Framework

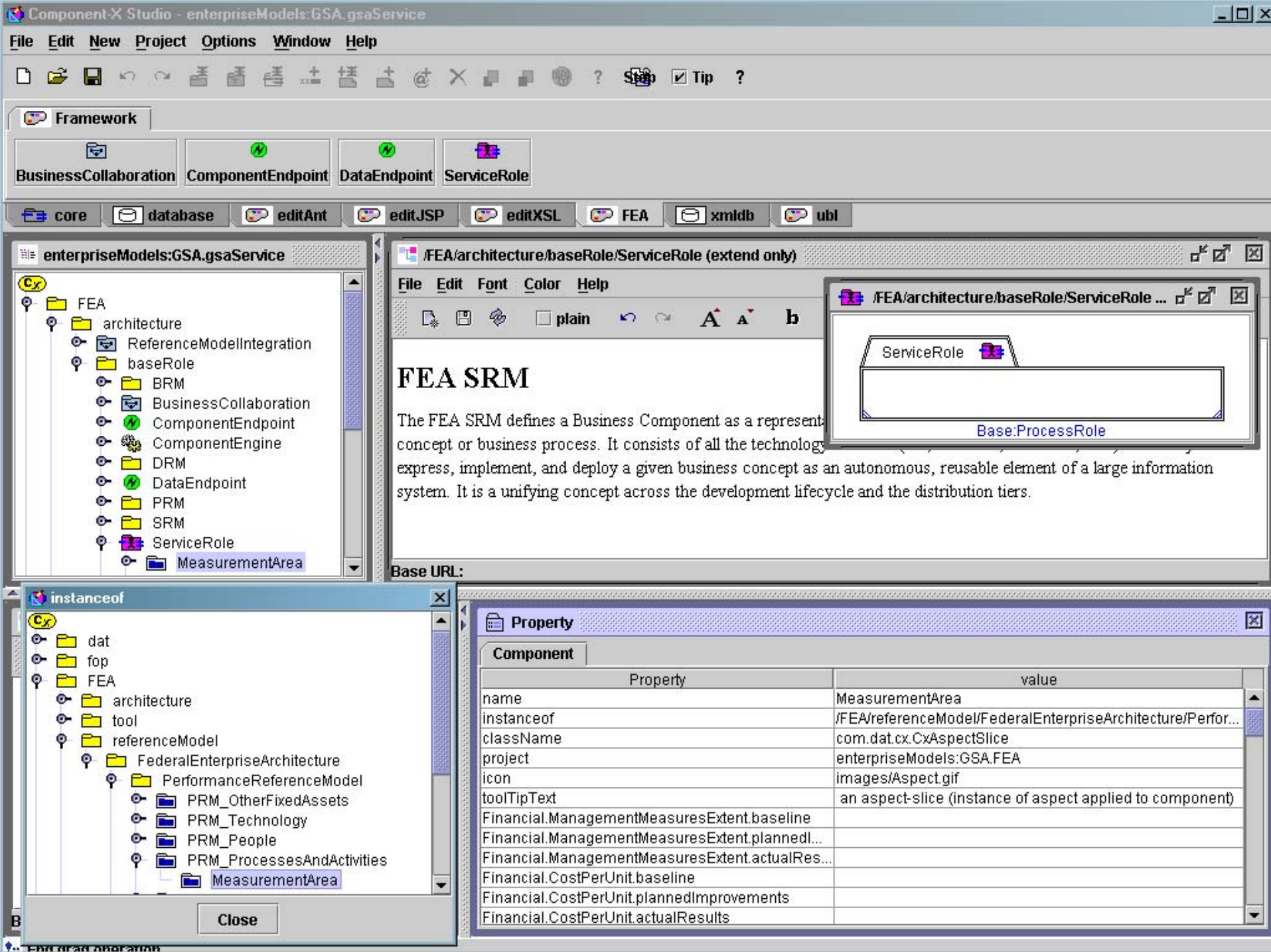


enterpriseModels:GSA.gsaService

- FEA
 - architecture
 - ReferenceModelIntegration
 - baseRole
 - BRM
 - BusinessCollaboration
 - ComponentEndpoint
 - ComponentEngine
 - DRM
 - DataEndpoint
 - PRM
 - SRM
 - ServiceRole
 - TRM
 - base_import_definitions
 - base_model_elements
 - demo
 - referenceModel
 - tool
 - welcome.jsp
 - GSA
 - dat
 - fop
 - ubl
 - xmldb

/FEA/architecture/baseRole (extend only)

base_import_definitions	base_model_elements
<p>baseRole</p> <p>SRM</p> <p>serviceComponentReferenceModelVersion:</p> <p>BRM</p> <p>BRM, business reference model Nested component</p> <p>DRM</p> <p>PRM</p> <p>TRM</p> <p>technicalReferenceModelVersion:</p>	<p>ServiceRole</p> <p>DataEndpoint</p> <p>ComponentEngine</p> <p>BusinessCollaboration</p>

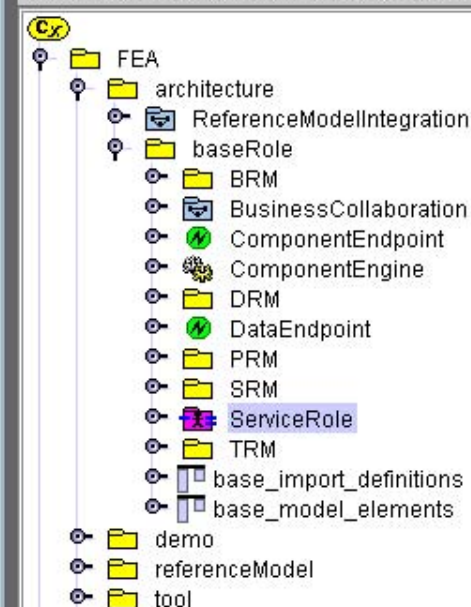




Framework



enterpriseModels:GSA.gsaService



/FEA/architecture/baseRole/Serv

File Edit Font Color Help



FEA SRM

The FEA SRM defines a Business C
concept or business process. It can
express, implement, and deploy a gi
system. It is a unifying concept acro

Base URL:

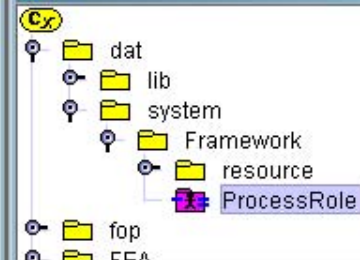
Subtype List

- /FEA/tool/FEA/Framework/ServiceRole
- /GSA/business/BuyerAgentSellerMarketPlace/role/AgencyBuyer
- /GSA/business/BuyerAgentSellerMarketPlace/BuyerAgentSellerMarke
- /GSA/business/BuyerAgentSellerMarketPlace/role/IndustryPartnerSell
- /GSA/business/BuyerAgentSellerMarketPlace/BuyerAgentSellerMarke
- /GSA/business/BuyerAgentSellerMarketPlace/role/GSAbuySell
- /GSA/business/BuyerAgentSellerMarketPlace/BuyerAgentSellerMarke
- /GSA/business/role/AcquisitionManagement
- /GSA/business/MarketPlace/AcquisitionManagement
- /GSA/business/role/FundsTransferAgent
- /GSA/business/MarketPlace/FundsTransferAgent
- /GSA/business/role/ChannelManagement
- /GSA/business/MarketPlace/ChannelManagement
- /GSA/business/role/ServiceDeliveryManagement
- /GSA/business/MarketPlace/ServiceDeliveryManagement
- /GSA/business/role/SettlementManagement
- /GSA/business/MarketPlace/SettlementManagement

Open

Cancel

instanceof



Close

Property

Component PRM_ProcessesAndActivities

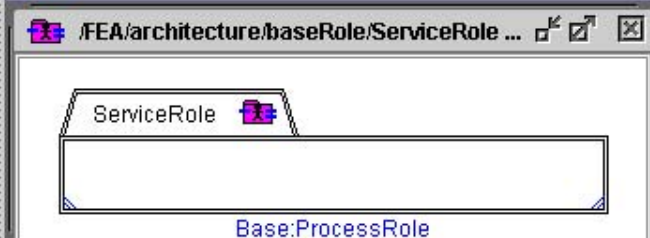
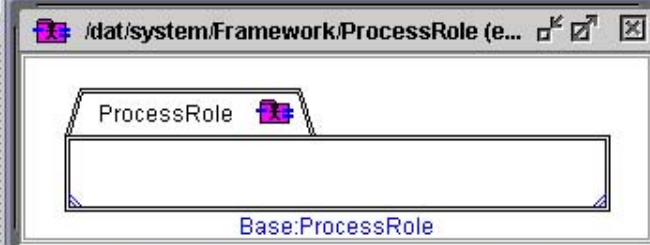
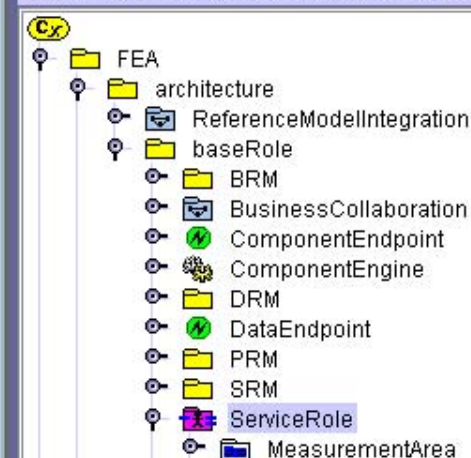
Property	value
name	ServiceRole
instanceof	/dat/system/Framework/ProcessRole
className	com.dat.cx.CxRoleComponent
project	enterpriseModels:GSA.FEA
icon	images/comp2role.gif
toolTipText	base service role for FEA/PRM processes



Framework



enterpriseModels:GSA.gsaService



Apply Aspect

SRM_Imagery
 SRM_Inbound_Correspondence_Management
 SRM_Indexing
 SRM_Information_Mapping__Taxonomy
 SRM_Information_Retrieval
 SRM_Information_Sharing
 SRM_Instant_Messaging
 SRM_Instrumentation_and_Testing
 SRM_Intrusion_Detection
 SRM_Invoice__Requisition_Tracking_and_Approval
 SRM_Knowledge_Capture
 SRM_Knowledge_Discovery
 SRM_Knowledge_Distribution_and_Delivery
 SRM_Knowledge_Engineering
 SRM_Legacy_Integration
 SRM_Library__Storage
 SRM_License_Management
 SRM>Loading_and_Archiving
 SRM_Mapping__Geospatial__Elevation__GPS
 SRM_Mathematical

OK Cancel

Documentation ServiceRole

Editor

FEA SRM

The FEA SRM defines a Business Component as a representation of the implementation of an autonomous business concept or business process. It consists of all the technology elements (i.e., software, hardware, data) necessary to express, implement, and deploy a given business concept as an autonomous, reusable element of a large information system. It is a unifying concept

Base URL:

End drag operation

Property

Component PRM_ProcessesAndActivities

Property	value
name	ServiceRole
instanceof	/dat/system/Framework/ProcessRole
className	com.dat.cx.CxRoleComponent
project	enterpriseModels:GSA.FEA
icon	images/comp2role.gif
toolTipText	base service role for FEA/PRM processes

- ubl
 - business
 - data
 - DespatchAdviceDB
 - InvoiceDB
 - OrderCancellationDB
 - OrderDB
 - OrderResponseDB
 - OrderResponseSimpleDB
 - ReceiptAdviceDB
 - ResourceEndpoint
 - Xmldb
 - component
 - element
 - type
 - DespatchAdvice
 - Invoice
 - Order
 - OrderCancellation
 - OrderResponse
 - OrderResponseSimple
 - ReceiptAdvice
 - cat
 - cct

OrderType

- ABC ID 0..1
- IssueDate 0..1
- ABC AcknowledgementResponseCode 0..1
- ABC TransactionCurrencyCode 0..1
- ABC PricingCurrencyCode 0..1
- EarliestDate 0..1
- CancelledByDate 0..1
- ValidityDurationMeasure 0..1
- LineitemCountQuantity 0..1
- TaxTotalAmount 0..1
- LineExtensionTotalAmount 0..1
- TotalPackagesCountQuantity 0..1
- GrossWeightMeasure 0..1
- NetWeightMeasure 0..1
- NetNetWeightMeasure 0..1
- GrossVolumeMeasure 0..1
- NetVolumeMeasure 0..1
- BuyerParty 0..1
- SellerParty 0..1
- FreightForwarderParty 0..1
- AllowanceCharge 0..*
- SalesConditions 0..1

OrderResponseType

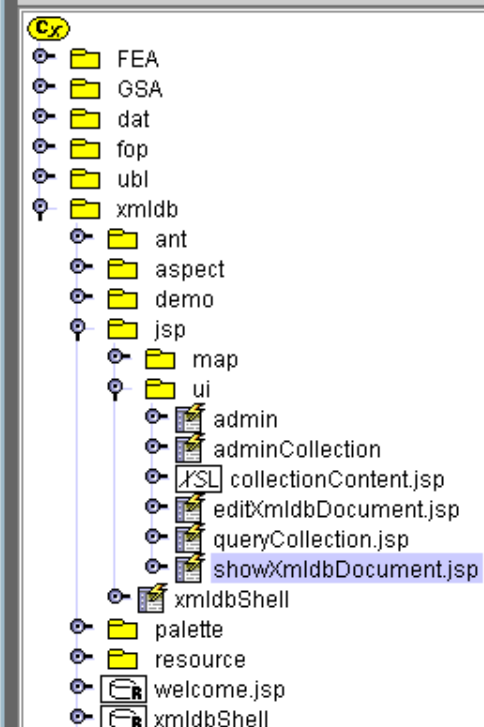
- ABC ID 0..1
- IssueDate 0..1
- ABC TransactionCurrencyCode 0..1
- ABC PricingCurrencyCode 0..1
- EarliestDate 0..1
- CancelledByDate 0..1
- ValidityDurationMeasure 0..1
- LineitemCountQuantity 0..1
- TaxTotalAmount 0..1
- LineExtensionTotalAmount 0..1
- TotalPackagesCountQuantity 0..1
- GrossWeightMeasure 0..1
- NetWeightMeasure 0..1
- NetNetWeightMeasure 0..1
- GrossVolumeMeasure 0..1
- NetVolumeMeasure 0..1
- ReferencedOrder 0..1
- BuyerParty 0..1
- SellerParty 0..1
- FreightForwarderParty 0..1
- AllowanceCharge 0..*
- SalesConditions 0..1
- DeliveryTerms 0..1

Editor

```
<ccts:ABIE dictionaryEntryName="Order Response. Details"
definition="information directly relating to the order response."/
```

Base URL:

Component	
Property	value
Content Type	composite
Content Constraint	optional
Or In	no



```
<jsp:root xmlns:jsp="http://java.sun.com/jsp_1_2" xmlns:c="/jstl-c" xmlns:fmt="/jstl-fmt" xmlns:x="/jstl-x" xmlns:map="/map"
xmlns:cx="/cx" xmlns:sql="/jstl-sql">
  <jsp:directive.page isThreadSafe="true" errorPage="/ui/error" contentType="text/xml; charset=ISO-8859-1"/>
  <map:new className="com.d_a_t.jsp.MapFacility" var="baseMap" value="${pageContext}" scope="request"/>
    <c:set var="me" value="${baseMap.component}"/>

    <c:set var="dbresourceFactory" value="${me.propertyMap['dbresourceFactory']}/>
    <c:set var="collection" value="${dbresourceFactory.component.resource}"/>

    <map:new className="com.d_a_t.jsp.XmldbWrapper" var="collectionWrapper" value="${collection}" scope="request"/>

    <map:set var="document" value="${param.document}" property="getResourceFromPathName"
target="${collectionWrapper}"/>
    <jsp:directive.include file="/dat/jsp/transform/xmlPassThrough.jsp"/>

    <c:set var="node" value="${document.resource.contentAsDOM}"/>

<x:transform xml="${node}" xslt="${xmlPassThrough}"/>
</jsp:root>
```

Base URL:

Property	value
name	showXmldbDocument.jsp
instanceof	/xmldb/jsp/xmldbShell
className	com.dat.cx.lib.CxJspFilter

[4] Demo – GSA PSM Trace with ComponentX

- Next 11 slides are screen shots from Live Demo of a notional ‘to-be’ GSA EA model in ComponentX, which traces through each and every component in the business collaborations that have been modeled



Framework control

CommunityProcess DataSource

core database

Debug Facilities

Trace Document

Received C...

Next Window

Ctrl-Tab

Previous Window

Ctrl+Shift-Tab

☒ Property☒ Documentation

Close All

Debug Facilities

Processes

Configuration Options

Adapters

? Stop Tip ?

utility

ResourceEndpoint

input

interface

output

protocol

FEA

xmldb

ubl

Debug Facilities including:

● Trace Management

- Trace event sequence and trace activation options
- View exchanged documents
- View trace context

● Breakpoint Management

- View/activate breakpoints
- View breakpoint context

● Trace Filter Management

- View/activate trace filters
- View trace view context

Filter Context

log

Context

last event on: /GSA/simulation/BuyerAgentSellerMarketPlaceEngine/transformBuyerPurchase.jsp/processDocument/output

Clear Trace







☒ Trace All ☐ Trace Filters ☐ Trace Breakpoints ☐ Trace Off

Provisioning

[Use](#)[Tree](#)[Index](#)[Help](#)*Component-X™2*[PREV Component](#) [NEXT Component](#)[FRAMES](#) [NO FRAMES](#)SUMMARY: [Diagram](#) [Provisioning](#) [Description](#) [Components](#)DETAIL: [Attributes](#) [Ports](#) [Properties](#) [Aspects](#)

enterpriseModels:GSA.gsaService BuyerPurchase.jsp

Order

-  JoineryOrderInstance1-long.xml ... as type:
-  JoineryOrderInstance1.xml ... as type:
-  OfficeOrderInstance1-long.xml ... as type:
-  OfficeOrderInstance1.xml ... as type:
-  UN220OrderInstance1-long.xml ... as type:
-  UN220OrderInstance1.xml ... as type:

[Use](#)[Tree](#)[Index](#)[Help](#)*Component-X™2*[PREV Component](#) [NEXT Component](#)[FRAMES](#) [NO FRAMES](#)SUMMARY: [Diagram](#) [Provisioning](#) [Description](#) [Components](#)DETAIL: [Attributes](#) [Ports](#) [Properties](#) [Aspects](#)*Component-X™2* Copyright

Data Access Technologies

14000 S.W. 119 Avenue

Miami, FL., 33186 USA

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Framework control filter ports XSL transform utility

CommunityProcess DataSource Endpoint Engine Operation ProcessRole ResourceEndpoint input interface output protocol

core database editAnt editJSP editXSL FEA xmldb ubl

Debug Facilities

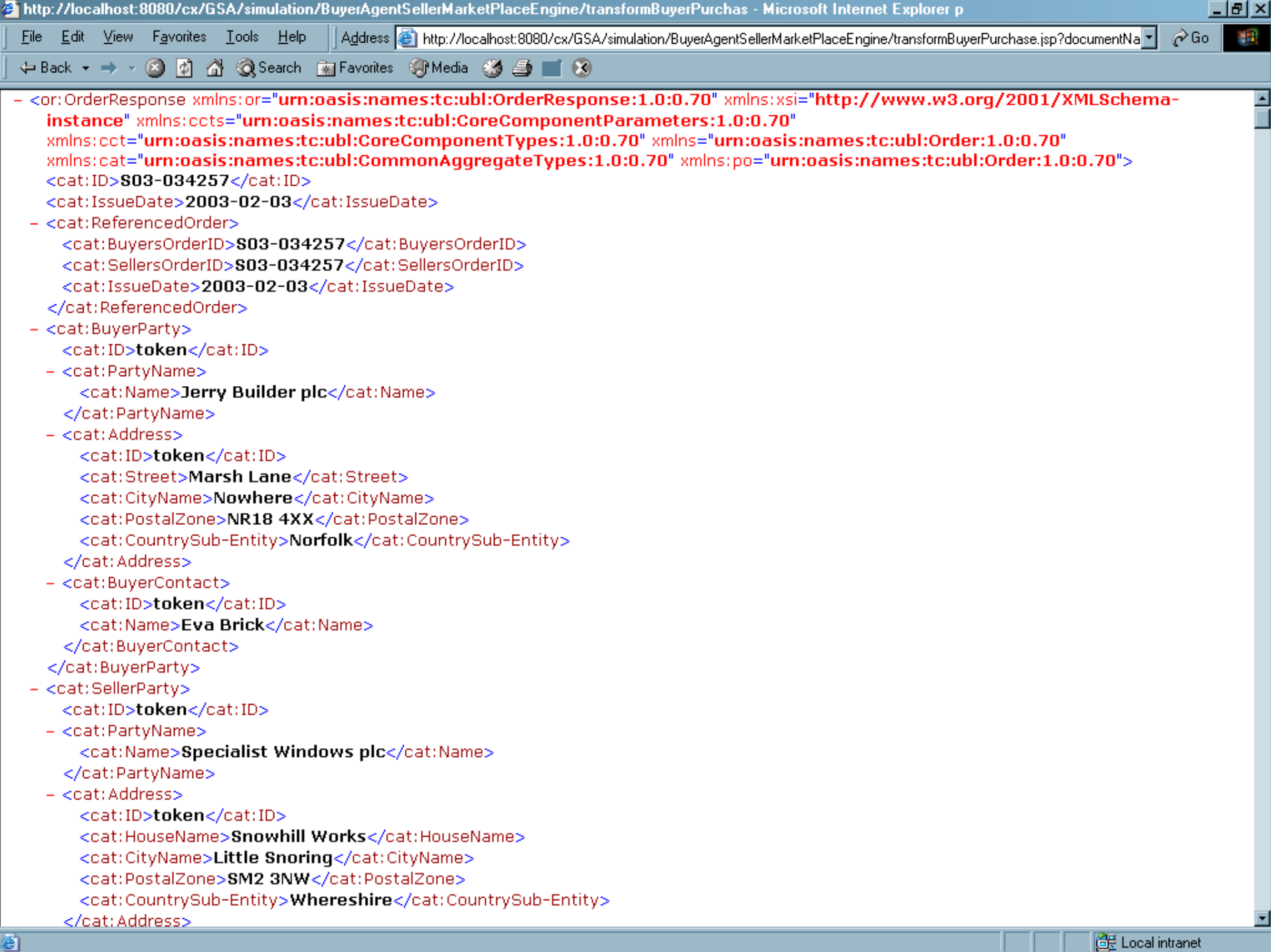
Trace Document Context Breakpoints Breakpoint Context Trace Filter Trace Filter Context log

Received On	Document	Context
OrderResponse	OrderResponse/defaultSessionId	CodeContractRulesIntoSettlementRules
OrderResponse	OrderResponse/defaultSessionId	SetupSettlement
input	OrderResponse/defaultSessionId	SettlementRules
output	OrderResponse/defaultSessionId	addOrderResponse
OrderResponse1	OrderResponse/defaultSessionId	SettlementRules
OrderResponse1	OrderResponse/defaultSessionId	SetupSettlement
OrderResponse1	OrderResponse/defaultSessionId	SetupSettlement
OrderResponse	OrderResponse/defaultSessionId	AcquisitionManagement
OrderResponse	OrderResponse/defaultSessionId	RecordModifyContractDetails
OrderResponse	OrderResponse/defaultSessionId	AcquisitionManagement
input	OrderResponse/defaultSessionId	Contracts
output	OrderResponse/defaultSessionId	addOrderResponse
OrderResponse1	OrderResponse/defaultSessionId	Contracts
OrderResponse1	OrderResponse/defaultSessionId	AcquisitionManagement
OrderResponse	OrderResponse/defaultSessionId	RecordModifyContractDetails
OrderResponse	OrderResponse/defaultSessionId	AcquisitionManagement
OrderResponse	OrderResponse/defaultSessionId	GSAbuySell
OrderResponse	OrderResponse/defaultSessionId	GSAbuySellEngine
OrderResponse	OrderResponse/defaultSessionId	IndustryPartnerSellerEngine
OrderResponse	OrderResponse/defaultSessionId	Purchasing
OrderResponse	OrderResponse/defaultSessionId	AcquisitionManagement
OrderResponse	OrderResponse/defaultSessionId	GSAbuySell
OrderResponse	OrderResponse/defaultSessionId	GSAbuySell
OrderResponse	OrderResponse/defaultSessionId	BuyerAgentSellerMarketPlaceEngine
output	OrderResponse/defaultSessionId	transformBuyerPurchase.jsp

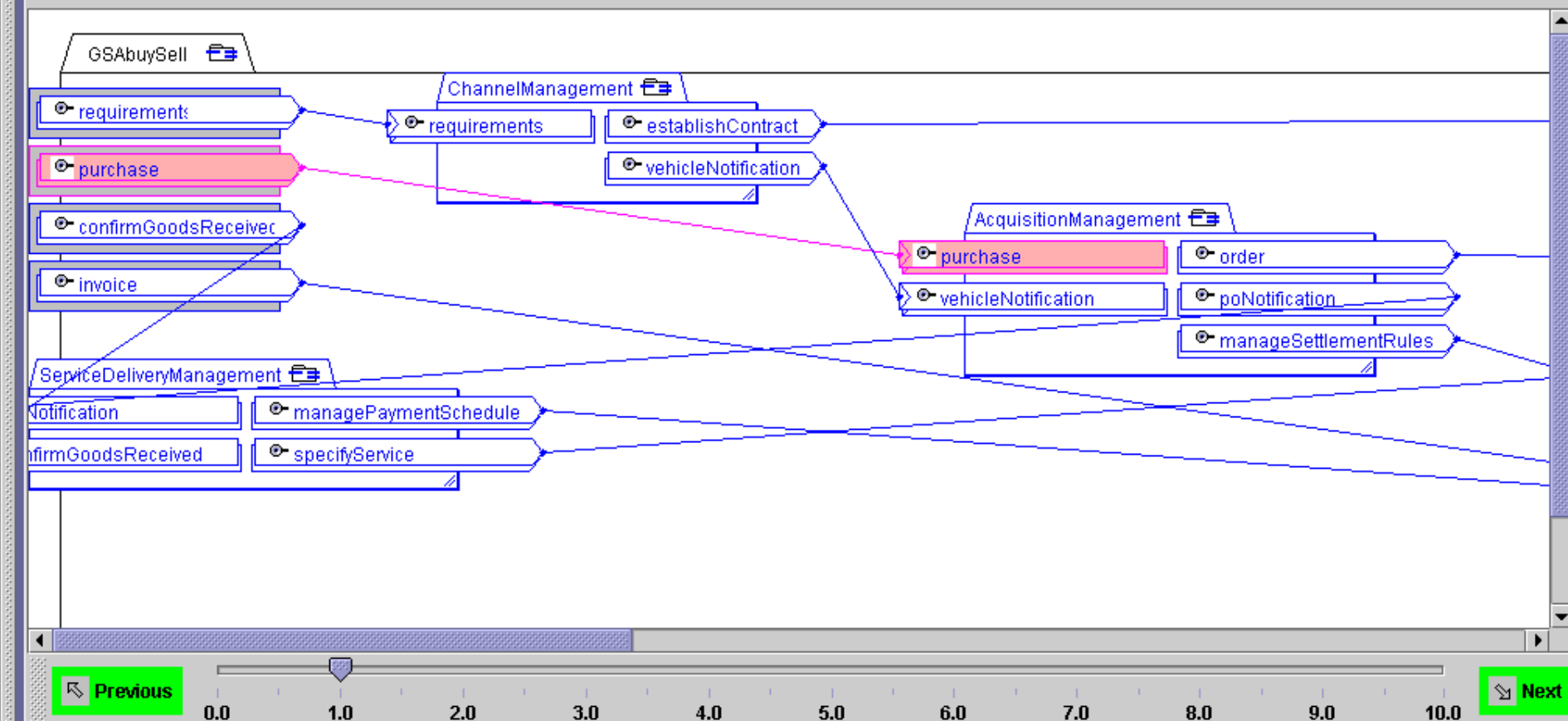
last event on: /GSA/simulation/BuyerAgentSellerMarketPlaceEngine/transformBuyerPurchase.jsp/processDocument/output

Clear Trace ☒ Trace All ☐ Trace Filters ☐ Trace Breakpoints ☐ Trace Off

Provisioning

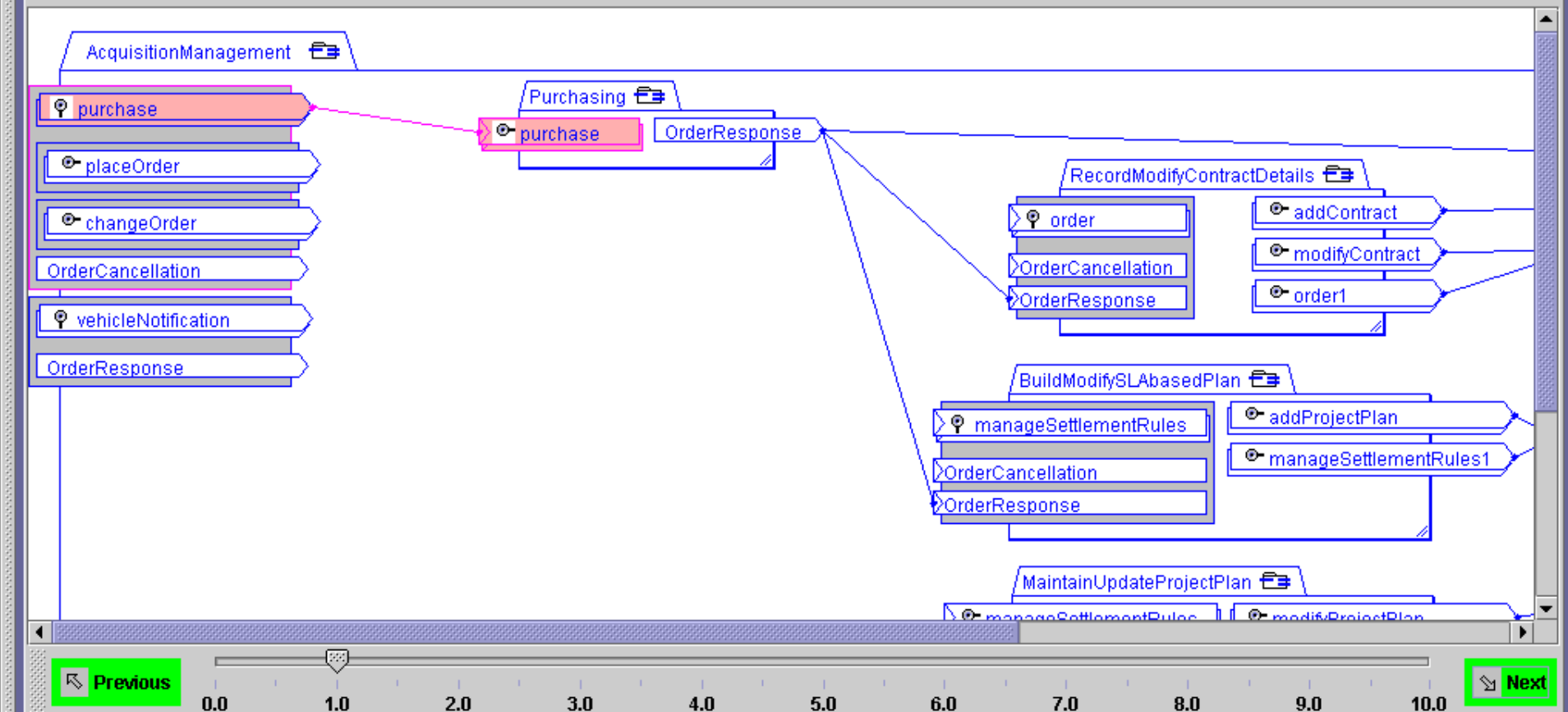


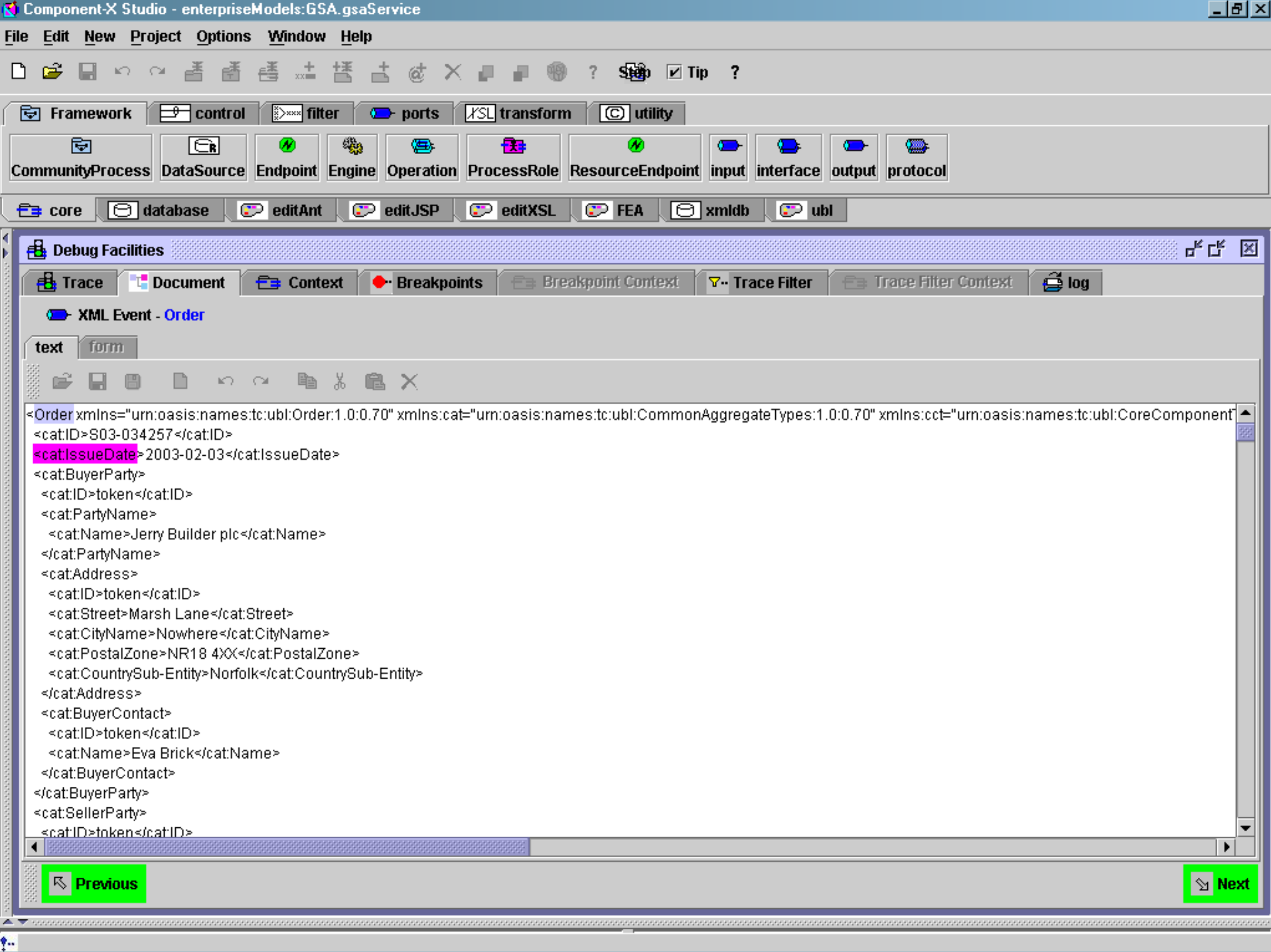
```
- <or:OrderResponse xmlns:or="urn:oasis:names:tc:ubl:OrderResponse:1.0:0.70" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:ccts="urn:oasis:names:tc:ubl:CoreComponentParameters:1.0:0.70"
xmlns:cct="urn:oasis:names:tc:ubl:CoreComponentTypes:1.0:0.70" xmlns="urn:oasis:names:tc:ubl:Order:1.0:0.70"
xmlns:cat="urn:oasis:names:tc:ubl:CommonAggregateTypes:1.0:0.70" xmlns:po="urn:oasis:names:tc:ubl:Order:1.0:0.70">
  <cat:ID>S03-034257</cat:ID>
  <cat:IssueDate>2003-02-03</cat:IssueDate>
  - <cat:ReferencedOrder>
    <cat:BuyersOrderID>S03-034257</cat:BuyersOrderID>
    <cat:SellersOrderID>S03-034257</cat:SellersOrderID>
    <cat:IssueDate>2003-02-03</cat:IssueDate>
  </cat:ReferencedOrder>
  - <cat:BuyerParty>
    <cat:ID>token</cat:ID>
    - <cat:PartyName>
      <cat:Name>Jerry Builder plc</cat:Name>
    </cat:PartyName>
    - <cat:Address>
      <cat:ID>token</cat:ID>
      <cat:Street>Marsh Lane</cat:Street>
      <cat:CityName>Nowhere</cat:CityName>
      <cat:PostalZone>NR18 4XX</cat:PostalZone>
      <cat:CountrySub-Entity>Norfolk</cat:CountrySub-Entity>
    </cat:Address>
    - <cat:BuyerContact>
      <cat:ID>token</cat:ID>
      <cat:Name>Eva Brick</cat:Name>
    </cat:BuyerContact>
  </cat:BuyerParty>
  - <cat:SellerParty>
    <cat:ID>token</cat:ID>
    - <cat:PartyName>
      <cat:Name>Specialist Windows plc</cat:Name>
    </cat:PartyName>
    - <cat:Address>
      <cat:ID>token</cat:ID>
      <cat:HouseName>Snowhill Works</cat:HouseName>
      <cat:CityName>Little Snoring</cat:CityName>
      <cat:PostalZone>SM2 3NW</cat:PostalZone>
      <cat:CountrySub-Entity>Whereshire</cat:CountrySub-Entity>
    </cat:Address>
```



Debug Facilities

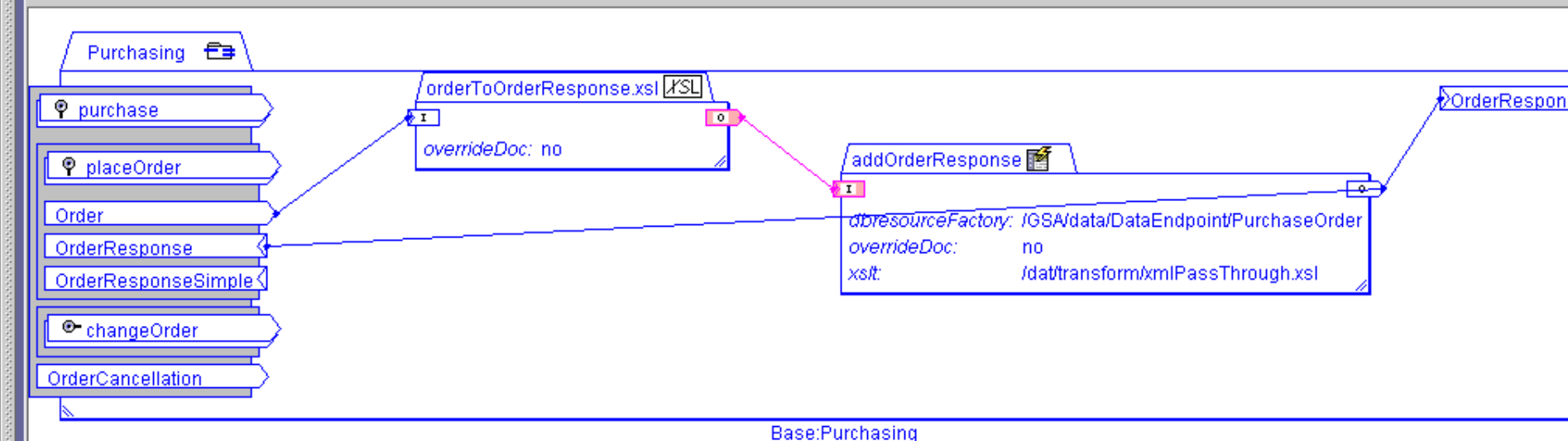
context AcquisitionManagement





Debug Facilities

context Purchasing





database formatConversions processing updateQuery

JoineryInvoice-htmlfo.xml JoineryInvoice-us.xml JoineryOrder-htmlfo.xml JoineryOrder-us.xml OfficeInvoice-htmlfo.xml OfficeInvoice-us.xml OfficeOrder-htmlfo.xml

core database editAnt editJSP editXML FEA xmldb ubl

Debug Facilities

Trace Document Context Breakpoints Breakpoint Context Trace Filter Trace Filter Context log

XML Event - input

text form



```
<or:OrderResponse xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:ccts="urn:oasis:names:tc:ubl:CoreComponentParameters:1.0:0.70" xmlns:cct="urn:oasis:na
<cat:ID>S03-034257</cat:ID>
<cat:IssueDate>2003-02-03</cat:IssueDate>
<cat:ReferencedOrder>
  <cat:BuyersOrderID>S03-034257</cat:BuyersOrderID>
  <cat:SellersOrderID>S03-034257</cat:SellersOrderID>
  <cat:IssueDate>2003-02-03</cat:IssueDate>
</cat:ReferencedOrder>
<cat:BuyerParty>
  <cat:ID>token</cat:ID>
  <cat:PartyName>
    <cat:Name>Jerry Builder plc</cat:Name>
  </cat:PartyName>
  <cat:Address>
    <cat:ID>token</cat:ID>
    <cat:Street>Marsh Lane</cat:Street>
    <cat:CityName>Nowhere</cat:CityName>
    <cat:PostalZone>NR18 4XX</cat:PostalZone>
    <cat:CountrySub-Entity>Norfolk</cat:CountrySub-Entity>
  </cat:Address>
  <cat:BuyerContact>
```

ok

Previous

Next

File Edit View Favorites Tools Help Address <http://localhost:8080/cx/GSA/demo/Engine/traceToPerformance.pdf?component=/GSA> Go

Back Forward Stop Home Search Favorites Media


111%

Adobe

Bookmarks

- 1 Introduction
- 2 Community Processes
 - 2.1 BuyerAgentSellerMarketPlace
 - 2.2 MarketPlace
- 3 Roles
 - 3.1 AcquisitionManagement
 - 3.2 AgencyBuyer
 - 3.3 Buyer
 - 3.4 ChannelManagement
 - 3.5 Consumer
 - 3.6 Customer
 - 3.7 FundsTransferAgent
 - 3.8 GSABuySell
 - 3.9 IndustryPartner
 - 3.10 IndustryPartnerSeller
 - 3.11 Payee
 - 3.12 Payor
 - 3.13 Provider
 - 3.14 Seller
 - 3.15 ServiceDeliveryManagement
 - 3.16 SettlementManagement
- 4 Engines
 - 4.1 GSABuySellEngine
 - 4.2 IndustryPartnerSellerEngine
- 5 Endpoints
 - 5.1 GSABuySellEndpoint
 - 5.2 IndustryPartnerSellerEndpoint
 - 5.3 UnallocatedEndpoint
- 6 Resource Endpoints
 - 6.1 DataEndpoint
- 7 Implementations

Performance View GSA - p. 1

Performance View  GSA

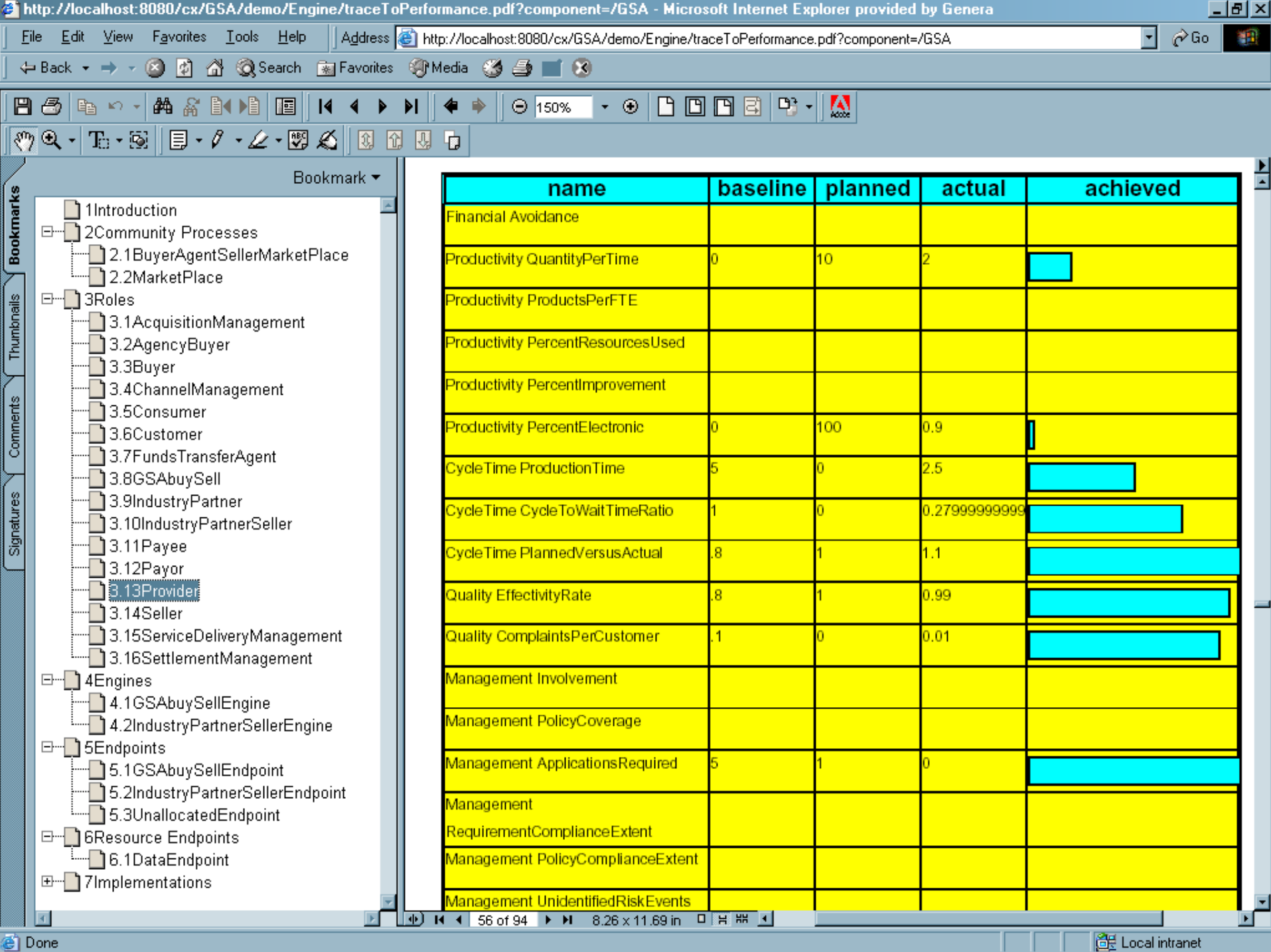
enterpriseModels:GSA.gsaBusiness
270

COMPONENT-X™

*The open standards-based Java-XML
solution for worldwide computing*

1 of 94 8.26 x 11.69 in

Done Local intranet

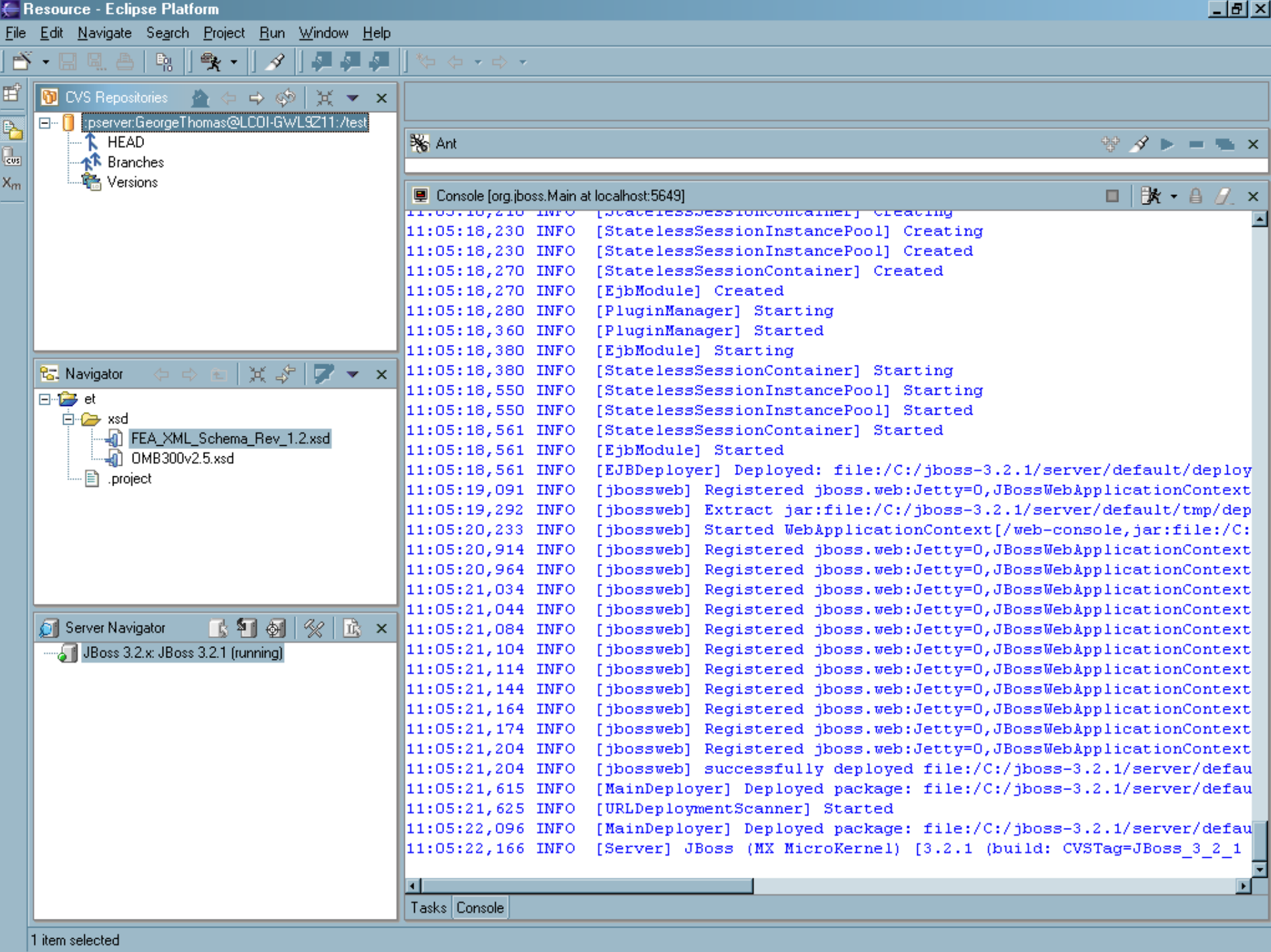


[4] What We Just Saw

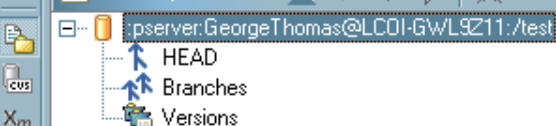
- Model as EA Repository
 - Dynamic JIT EA artifact generation (in any format, accessible via the Web) from model annotations and associations
 - Tracing through a model ‘run’ to generate a PRM ‘line of sight’
 - Measurable metrics! Pick your favorite – ABM, TQM, 6Sigma, etc.
 - Since we have associated CPIC annotated *aspects* to our model, an OMB 300 is an output of, or derived from the model
 - Same for a Security Profile (or RM)
- Core MDA Value Proposition
 - Various abstraction levels (PIM to PSM linkage), component granularity as a recursive decomposition of components in roles
 - Code generation - the implementations (PSM) of roles are the components!!
 - Contrast with current ‘requirements’ notions
 - Provisioning as a deployment ‘adapter aspect’ decision
 - e.g. WSDL or JMS?

[5] OSERA Project: MDA-IME Goals, 1 of 2

- In addition to PortMan POC capabilities shown;
 - Repository Federation
 - XMI based Syndication and Configuration Management
 - Semantic technologies application (XMI to XTM/OWL transformation) to PIM/PSM levels of abstraction as XMI syndication points
 - » Input to FEAMS and various Reg/Rep's
 - XForms based plug in for structured model annotations, ala NASCIO templates
 - Extending Eclipse: MDA-IME + SOIP-BPMS
 - PSM target platform as OSERA Project: SOIP-BPMS
 - JBOSS IDE (Eclipse + JBOSS)
 - » JMX based managing SOIP clusters/cloud

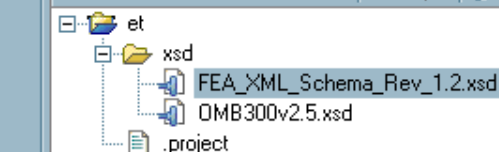


CVS Repositories

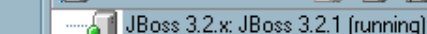


Xm

Navigator



Server Navigator



Ant

Console [org.jboss.Main at localhost:5649]

```
11:05:18,210 INFO [StatelessSessionContainer] Creating
11:05:18,230 INFO [StatelessSessionInstancePool] Creating
11:05:18,230 INFO [StatelessSessionInstancePool] Created
11:05:18,270 INFO [StatelessSessionContainer] Created
11:05:18,270 INFO [EjbModule] Created
11:05:18,280 INFO [PluginManager] Starting
11:05:18,360 INFO [PluginManager] Started
11:05:18,380 INFO [EjbModule] Starting
11:05:18,380 INFO [StatelessSessionContainer] Starting
11:05:18,550 INFO [StatelessSessionInstancePool] Starting
11:05:18,550 INFO [StatelessSessionInstancePool] Started
11:05:18,561 INFO [StatelessSessionContainer] Started
11:05:18,561 INFO [EjbModule] Started
11:05:18,561 INFO [EJBDeployer] Deployed: file:/C:/jboss-3.2.1/server/default/deploy
11:05:19,091 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:19,292 INFO [jbossweb] Extract jar:file:/C:/jboss-3.2.1/server/default/tmp/dep
11:05:20,233 INFO [jbossweb] Started WebApplicationContext[/web-console,jar:file:/C:
11:05:20,914 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:20,964 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,034 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,044 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,084 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,104 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,114 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,144 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,164 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,174 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,204 INFO [jbossweb] Registered jboss.web:Jetty=0,JBossWebApplicationContext
11:05:21,204 INFO [jbossweb] successfully deployed file:/C:/jboss-3.2.1/server/defau
11:05:21,615 INFO [MainDeployer] Deployed package: file:/C:/jboss-3.2.1/server/defau
11:05:21,625 INFO [URLDeploymentScanner] Started
11:05:22,096 INFO [MainDeployer] Deployed package: file:/C:/jboss-3.2.1/server/defau
11:05:22,166 INFO [Server] JBoss (MX MicroKernel) [3.2.1 (build: CVSTag=JBoss_3_2_1
```

[5] OSERA Project: MDA-IME Goals, 2 of 2

- In addition to PortMan POC capabilities shown;
 - Industrial strength MOF
 - Versioning, lifecycle maintenance
 - Decoupled persistence layer
 - » unlike CVS, perhaps using Xindice
 - Collapse the CPIC and SDLC cycle, significantly reducing resource burden and overall timelines
 - ‘diff’ the ‘as-is’ and ‘to-be’ to generate Sequence Plan template
 - Based on configuration dependencies
 - Actionable EA Formalism (AEF)
 - FEA ‘built-in’
 - Standard set of Views, EDOC - Other?
 - FOSS!!

[6] SBIR/STTR Opportunity

- STTR for OSERA Project: MDA-IME
 - Ontological mapping leads to synthesized meta-model
 - Merging BPMN/BPML-BPEL and EDOC Object Model
 - Defining the correct/complete FEA OO
 - UI meta-model
 - XHTML, WSRP/WSIA, PDF synthesis
- SBIR for OSERA Project: SOIP-BPMS
 - Rationalize object models
 - JetSpeed to WSRP/WSIA and EJB
 - Architectural Style-Deployment decisions
 - Trans-coding Proxy or data Bridge pattern?
- SBIR for OSERA Program/Platform (?)
 - Business and Legal Model

For More Information

- Contact me!
 - George Thomas
 - GSA Enterprise Architect
 - g.thomas@gsa.gov
 - 202.219.1979
- About:
 - OSERA Program/Platform/Project support for;
 - EA and e-Gov Communities of Interest and Practice
 - and Open Source Software implementations of;
 - MDA
 - BPM
 - SOA
 - Web Services
 - J2EE
 - CBA